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TRIENNIAL REAPPRAISAL REPORT

BARNEGAT BAY-TOMS RIVER

1991-1998

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New Jersey Department of Environmental Protection
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EXECUTIVE SUMMARY

A total of 4,334 samples from the Barnegat Bay-Toms River area were collected, analyzed and evaluated from 133 sampling stations for total coliform (TC) and fecal coliform (FC) bacteria during the period November 1991 through September 1998. This time frame was selected to comply with the classification requirement of a minimum of 30 sets of data per sampling station for the waters of the Barnegat Bay that are sampled under the Systematic Random Sampling strategy. The sampling strategy for the Barnegat Bay was modified from Adverse Pollution Condition of rainfall to Systematic Random Sampling for the 1997-1998 Sampling Year.

In the Barnegat Bay the bacteriological data for each sampling station complies with or supports their respective criteria for *Approved*, *Seasonal* or *Special Restricted* classification under the Total Coliform Standard. Evaluation of the sampling data supports the current classification. The area is correctly classified. No changes are recommended.

The Toms River is sampled under the Adverse Pollution Condition of rainfall strategy. Limited sampling in the Toms River began in July 1994. The required number of sampling runs in the Toms River were not completed in 1997-1998 due to lack of rainfall and sampling priorities in other shellfish waters of the state. In the future, a potential upgrade of the Toms River from *Prohibited* to *Special Restricted* classification may be possible pending the collection and evaluation of additional bacteriological data and a favorable sanitary shoreline survey. It was recommended that the sampling strategy in the river be modified from Adverse Pollution Condition to Systematic Random Sampling in the 1998-1999 Sampling Year.

INTRODUCTION

PURPOSE

This report is part of a series of studies having a dual purpose. The first and primary purpose is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC). Reports generated under this program form the basis for classifying shellfish waters for the purpose of harvesting shellfish for

human consumption. As such, they provide a critical link in protecting human health.

The second purpose is to provide input to the State Water Quality Inventory Report, which is prepared pursuant to Section 305(b) of the Federal Clean Water Act (P.L. 95-217). The information contained in the growing

area reports is used for the New Jersey State Water Quality Inventory Report (305b) which provides an assessment to Congress every two years of current water quality conditions in the State's major rivers, lakes, estuaries, and ocean waters. The reports provide valuable information for the 305(b) report, which describes the waters that are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the actual or potential sources of pollution. Similarly, the reports utilize relevant information contained in the 305(b) report, since the latter assessments are based on in-stream monitoring data (temperature, oxygen, pH, total and fecal coliform bacteria, nutrients, solids, ammonia and metals), land-use profiles, drainage basin characteristics and other pollution source information.

From the perspective of the Shellfish Classification Program, the reciprocal use of water quality information from reports represent two sides of the same coin: the growing area report focuses on the estuary itself, while the 305(b) report

describes the watershed that drains to that estuary.

The Department participates in a cooperative National Environmental Performance Partnership System (NEPPS) with the USEPA which emphasizes ongoing evaluation of issues associated with environmental regulation, including assessing impacts on water bodies and measuring improvements in various indicators of environmental health. The shellfish growing area reports are intended to provide a brief assessment of the growing area, with particular emphasis on those factors that affect the quantity and quality of the shellfish resource. As the Department implements a comprehensive watershed management program in conjunction with the NEPPS initiative, the shellfish growing area reports provide valuable information on the overall quality of the saline waters in the most downstream sections of each major watershed. In addition, the reports assess the quality of the biological resource and provide a reliable indicator of potential areas of concern and/or areas where additional information is needed to accurately assess watershed dynamics.

HISTORY

As a brief history, the NSSP developed from public health principles and program controls formulated at the original conference on shellfish sanitation called by the Surgeon General of the United States Public Health Service in 1925. This conference was called after oysters were implicated in causing over 1500 cases of typhoid fever and 150 deaths in 1924. The tripartite cooperative program (federal, state and

shellfish industry) has updated the program procedures and guidelines through workshops held periodically until 1977. Because of concern by many states that the NSSP guidelines were not being enforced uniformly, a delegation of state shellfish officials from 22 states met in 1982 in Annapolis, Maryland, and formed the ISSC. The first annual meeting was held in 1983 and continues to meet annually at various locations

throughout the United States.

The NSSP *Guide for the Control of Molluscan Shellfish* sets forth the principles and requirements for the sanitary control of shellfish produced and shipped in interstate commerce in the United States. It provides the basis used by the Federal Food and Drug Administration (FDA) in evaluating state shellfish sanitation programs. The five major points on which the state is evaluated by the FDA include:

1. The classification of all actual and potential shellfish growing areas as to their suitability for shellfish harvesting.
2. The control of the harvesting of shellfish from areas that are

classified as restricted, prohibited or otherwise closed.

3. The regulation and supervision of shellfish resource recovery programs.
4. The ability to restrict the harvest of shellfish from areas in a public health emergency, and
5. Prevent the sale, shipment or possession of shellfish that cannot be identified as being produced in accordance with the NSSP and have the ability to condemn, seize or embargo such shellfish.

FUNCTIONAL AUTHORITY

The authority to carry out these functions is divided between the Department of Environmental Protection (DEP), the Department of Health and Senior Services and the Department of Law and Public Safety. The Bureau of Marine Water Monitoring (BMWM) under the authority of N.J.S.A. 58:24 classifies the shellfish growing waters and administers the special resource recovery programs. Regulations delineating the growing areas are promulgated at N.J.A.C. 7:12 and are revised annually. Special Permit rules are also found at N.J.A.C. 7:12 and are revised as necessary.

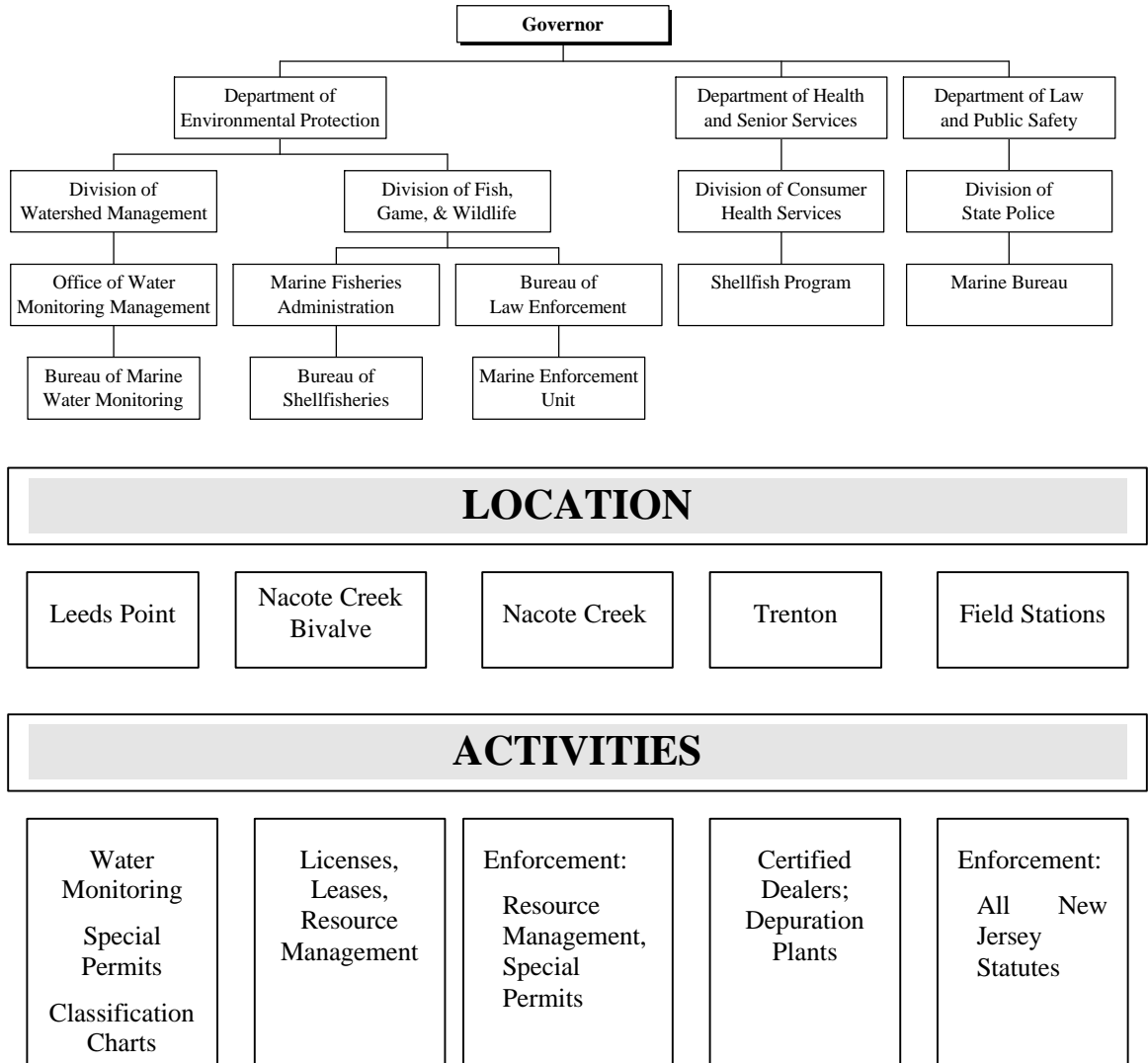
The Bureau of Shellfisheries in the Division of Fish, Game and Wildlife issues harvesting licenses and leases for

shellfish grounds under the Authority of N.J.S.A. 50:2 and N.J.A.C. 7:25. This bureau in conjunction with the BMWM administers the Hard Clam Relay Program.

The Bureau of Law Enforcement in the DEP (Division of Fish, Game, and Wildlife) and the Division of State Police in the Department of Law and Public Safety enforce the provisions of the statutes and rules mentioned above.

The Department of Health and Senior Services is responsible for the certification of wholesale shellfish establishments and in conjunction with the BMWM, administers the depuration program.

FIGURE 1: STATE OF NEW JERSEY SHELLFISH AGENCIES



IMPORTANCE OF SANITARY CONTROL OF SHELLFISH

Emphasis is placed on the sanitary control of shellfish because of the direct relationship between pollution of

shellfish growing areas and the transmission of diseases to humans. Shellfish borne infectious diseases are

generally transmitted via a fecal-oral route. The pathway is complex and quite circuitous. The cycle usually begins with fecal contamination of the shellfish growing waters. Sources of such contamination are many and varied. Contamination reaches the waterways via runoff and direct discharges.

Clams, oysters and mussels pump large quantities of water through their bodies during the normal feeding process. During this process the shellfish also concentrate microorganisms, which may include pathogenic microbes, and toxic heavy metals/chemicals. It is imperative that a system is in place to reduce the human health risk of consuming shellfish from areas of contamination.

Accurate classifications of shellfish growing areas are completed through a comprehensive sanitary survey. The

principal components of the sanitary survey report include:

1. An evaluation of all actual and potential sources of pollution,
2. An evaluation of the hydrography of the area and
3. An assessment of water quality. Complete intensive sanitary surveys are conducted every 12 years with interim narrative evaluations completed on a three year basis. If major changes to the shoreline or bacterial quality occur, then the intensive report is initiated prior to its 12 year schedule.

The following narrative constitutes this bureau's assessment of the above mentioned components and determines the current classification of the shellfish growing waters.

DESCRIPTION

LOCATION

The Barnegat Bay-Toms River Area is located in Ocean County. The area encompasses the shellfish waters of the Toms River and the central part of the Barnegat Bay. The location is shown in

Figure 2 and on Chart 4 of the 1999 State of New Jersey Shellfish Growing Water Classification Charts.

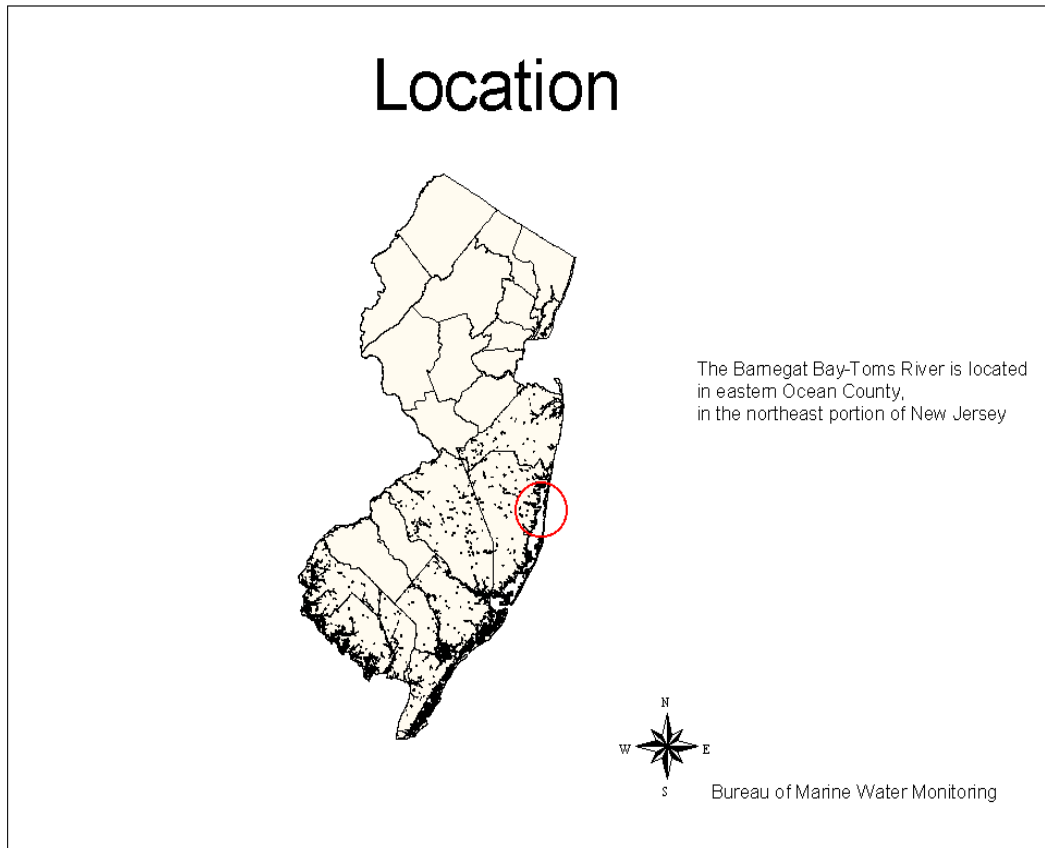


FIGURE 2: LOCATION OF SHELLFISH GROWING AREA TOMS RIVER-BARNEGAT BAY.

DESCRIPTION

The growing area extends from Toms River and the Route 37 Bridge southward approximately 8 miles to Forked River. The Barnegat Inlet is located approximately 6 miles southeast of the Forked River.

Most of the shellfish waters of the area are classified as *Approved*, with *Seasonal* and *Special Restricted* areas acting as buffer zones along the developed sections of the shoreline. The Toms River is classified as *Prohibited* shellfish waters. The shellfish water classifications are shown in Figure 3.

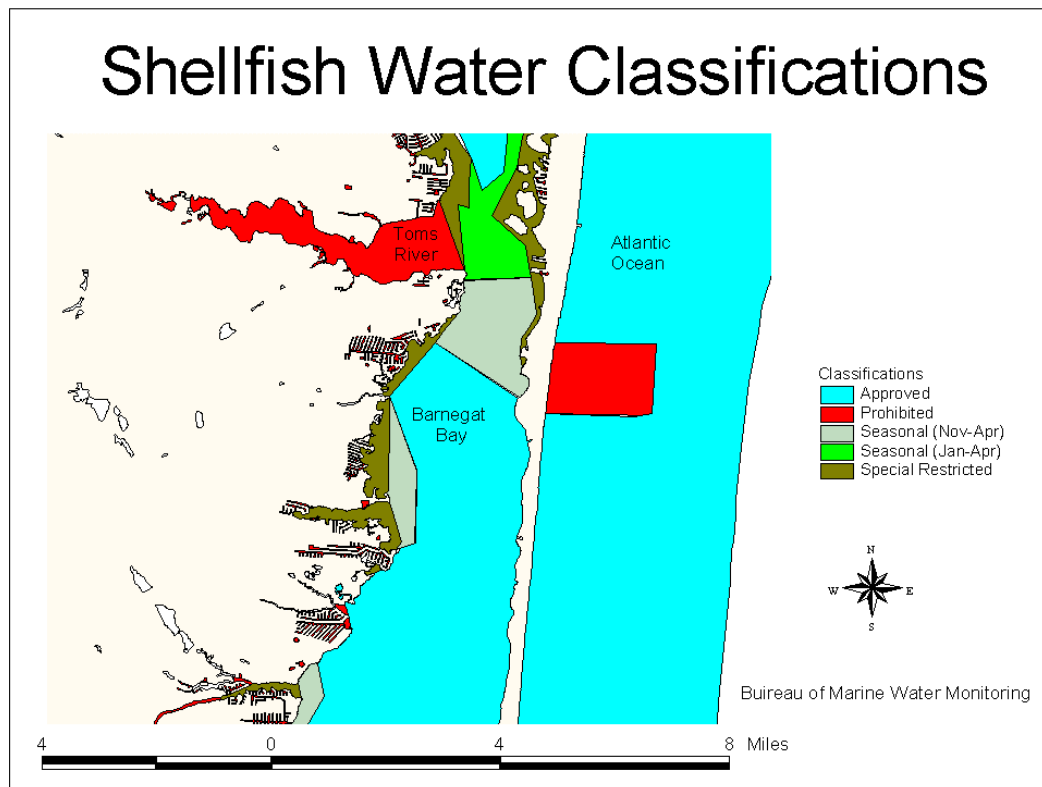


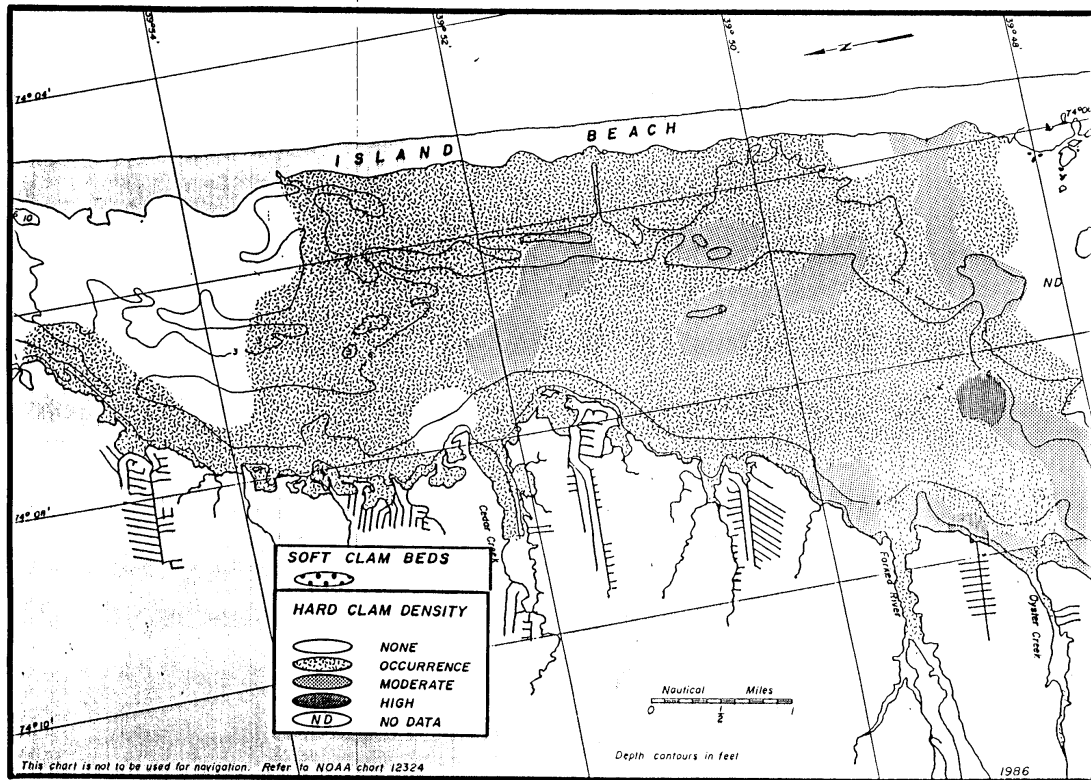
FIGURE 3: CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA TOMS RIVER-BARNEGAT BAY.

HISTORY

The Barnegat Bay-Toms River is divided into four sampling runs. One of the runs is under the Adverse Pollution Condition of rainfall. This assignment covers the Toms River. The other three runs cover the Barnegat Bay and were formerly sampled under the Adverse Pollution Condition of rainfall. The sampling strategy for these runs was modified to Systematic Random

Sampling for the 1997-1998 Sampling Year.

The Toms River is not a historically productive area for shellfish. In fact there are no viable shellfish resources in the Toms River-Barnegat Bay area north of the Cedar Creek (Joseph, 1999). A hard clam density chart dated 1986 is shown in Figure 4.



SOURCE: BUREAU OF SHELLFISHERIES, NACOTE CR. FIELD STATION.

FIGURE 4: HARD CLAM DENSITY (1986).

The shellfish waters of the Toms River are classified as *Prohibited*. The river has been under this designation for many years. An old copy of the 1968 Shellfish Classification Charts shows these waters as *Prohibited*. The industry has not expressed interest in harvesting shellfish from these waters because there are few shellfish reported there.

In July of 1994 bacteriological sampling in the Toms River began with a single sampling run of 30 stations. In 1995 seven sampling runs were made followed by two runs in 1996, nine runs

in 1997 and four runs in 1998. The sampling strategy in the Toms River is under the Adverse Pollution Condition of rainfall.

There are no effluent discharges into the shellfish waters of the river. This was not the case prior to the establishment of the Ocean County Utilities Authority's Central Water Pollution Control Facility located in Bayville. Today, the only remaining sanitary discharge in the Toms River Watershed is from a treatment facility at a small mobile home park located far upstream in Jackson Township. This discharge will terminate

in 2000 when the trailer park ties in with a public sewer line.

Bacteria levels in the Toms River are associated with non-point discharges from overland flow and storm water drain discharges (Farnsworth, 1997).

The most recent change to take place in shellfish water classification in the area occurred in 1998 when 1267 acres of the Barnegat Bay were reclassified from *Seasonal January* (January 1 through April 30) to *Seasonal November* (November 1 through April 30). The reclassification was a result of improving bacterial water quality in the area.

The last Sanitary Survey for the area was completed in 1988. At that time the area was divided into two report areas; the Sanitary Survey was completed one section. A Re-appraisal report was completed in 1997.

In 1995 the United States Environmental Protection Agency announced the inclusion of the Barnegat-Little Egg Harbor Bay into the National Estuary Program. The outcome of this endeavor will be to develop a Comprehensive

Conservation and Management Plan for the Barnegat Bay building on the existing Watershed Management Plan and other efforts to maintain the water quality and living resources of the Bay (Flimlin, 1996).

The NJDEP, Bureau of Marine Water Monitoring, is in a unique position to be able to contribute current and historic bacteriological water quality data to the Barnegat Bay Estuary Program in its effort to develop an updated characterization of water quality conditions, ecosystem characteristics and resource status in the Bay region.

In 1998 there were several bathing beach closures at the Hancock Avenue beach in Seaside Heights and at Beachwood Beach on the Toms River. The beach closings were associated with storm water drain discharge after rainfall. (Loftin, 1999). The shellfish harvesting waters were not impacted by the beach closings because adjacent waters are classified as *Prohibited, Special Restricted, or Seasonal*.

METHODS

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 1992).

Approximately 4300 water samples were collected for total and fecal coliform bacteria between 1991 and 1998 and analyzed by the three tube MPN method according to APHA (1970). Figure 11 shows the Shellfish Growing Water

Quality monitoring stations in the Barnegat Bay-Toms River. Approximately 130 sampling stations are monitored in this area.

Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, 1997.

Data management and analysis was

accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the

Geographic Information System (GIS:ARCVIEW).

BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

The water quality of each growing area must be evaluated before an area can be classified as *Approved*, *Seasonally Approved*, *Special Restricted*, or *Seasonal Special Restricted*. Criteria for bacterial acceptability of shellfish growing waters are provided in *NSSP Guide for the Control of Molluscan Shellfish*, 1997.

Each shellfish producing state is directed to adopt either the total Coliform criterion, or the fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, it does make corresponding fecal coliform determinations for each sampling station, these data are viewed as adjunct information and are not directly used for classification. The State Shellfish Control Authority also has the option of choosing one of the two water monitoring sampling strategies for each growing area.

The Adverse Pollution Condition Strategy requires that a minimum of five samples be collected each year under conditions that have historically resulted in elevated coliforms in the particular growing area. The results must be evaluated by adding the individual station sample results to the preexisting bacteriological sampling results to constitute a data set of at least 15 samples for each station. The adverse pollution conditions usually are related to tide, and rainfall, but could be from a point source of pollution or variation could occur during a specific time of the year. Under this strategy, for *Approved* waters, the

total coliform median or geometric mean MPN of the water shall not exceed 70 per 100 mL and not more than 10 percent of the samples exceed an MPN of 330 per 100 mL for the 3-tube decimal dilution test. For *Special Restricted* waters, the total coliform median or geometric mean MPN of the water shall not exceed 700 per 100 mL and not more than 10 percent of the samples exceed an MPN of 3300 per 100 mL for the 3-tube decimal dilution test. Areas to be *Approved* under the *Seasonal* classification must be sampled and meet the criterion during the time of the year that it is approved for the harvest of shellfish.

The Systematic Random Sampling strategy requires that a random sampling plan be in place before field sampling begins and can only be used in areas that are not affected by point sources of contamination. A minimum of six samples per station are to be collected each year and added to database to obtain a sample size of 30 for statistical analysis. The bacteriological quality of every sampling station in *Approved* areas shall have a total coliform median or geometric mean MPN not exceeding 70 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 330 per 100 mL. For *Special Restricted* areas, the bacteriological quality shall not exceed a total coliform median or geometric mean MPN of 700 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 3,300 per 100 mL.

The Toms River is sampled under the

Adverse Pollution Condition of rainfall and the Barnegat Bay area is sampled

under the Systematic Random Sampling strategy.

MARINE BIOTOXINS

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine biotoxins. This data is evaluated weekly by the Bureau of Marine Water Monitoring in accordance with the NSSP requirements. While this area of Barnegat Bay frequently exhibits algal blooms during the summer months, the

blooms have not included significant numbers of those species that are of human health concern related to shellfish consumption. An annual report is compiled by the Bureau of Freshwater and Biological Monitoring.

SHORELINE SURVEY

The last Sanitary Survey was completed in 1988.

DOMESTIC DISCHARGES

There are no known effluent discharges into the Barnegat Bay-Toms River shellfish waters. All sewage plant discharges are directed via pipeline into the Atlantic Ocean outside of the growing area.

A small sewage treatment plant is located at the Oak Tree Mobile Home Park in Jackson, Township. The facility has a permitted discharge of treated effluent to an unnamed tributary of the Toms River. As part of the treatment process, the effluent passes through two sand filters and a chlorination/de-chlorination process before discharge. The discharge rate is approximately 0.030 MGD (20 gpm). The facility has agreed to connect to the public sewer by the year 2000. This discharge is located many miles upstream and has no

significant impact on the shellfish waters of the Toms River.

Another small treatment facility is located at the Jackson Township school facility. This discharge is many miles upstream of the saline waters in the Toms River.

The Great Adventure Amusement Park located in Jackson Township provides treatment to the waste generated at the park. This waste is discharged to ground water.

Sanitary wastewater generated in the Toms River-Barnegat Bay growing area is treated by the Ocean County Utility Authority Central Water Pollution Control Facility. The plant is located three miles south of the Toms River and west of Route 9 in Bayville, Berkeley

Township. The capacity of the plant is 32 MGD. The facility pumps treated effluent a mile into the Atlantic Ocean at a location east of Seaside Park.

There have not been any significant problems with the plant operation. However, as a precautionary measure, the NSSP requires a closed safety zone so that ocean waters adjacent to the outfall line are classified as *Prohibited* for the harvesting of shellfish for a distance of 1.5 miles offshore. The ocean outfall line is not within the confines of the Toms River-Barnegat Bay growing area.

There are 19 pump stations located around the Toms River-Barnegat Bay area. They are well maintained and equipped with emergency alarms in case of a spill.

OTHER DIRECT DISCHARGES

Several Years ago the Ciba-Geigy Plant, located in Toms River, ceased all surface water discharges including the company's pipeline discharge to the Atlantic Ocean. Direct discharges to the shellfish waters of the Toms River-Barnegat Bay are shown in Figure 5.

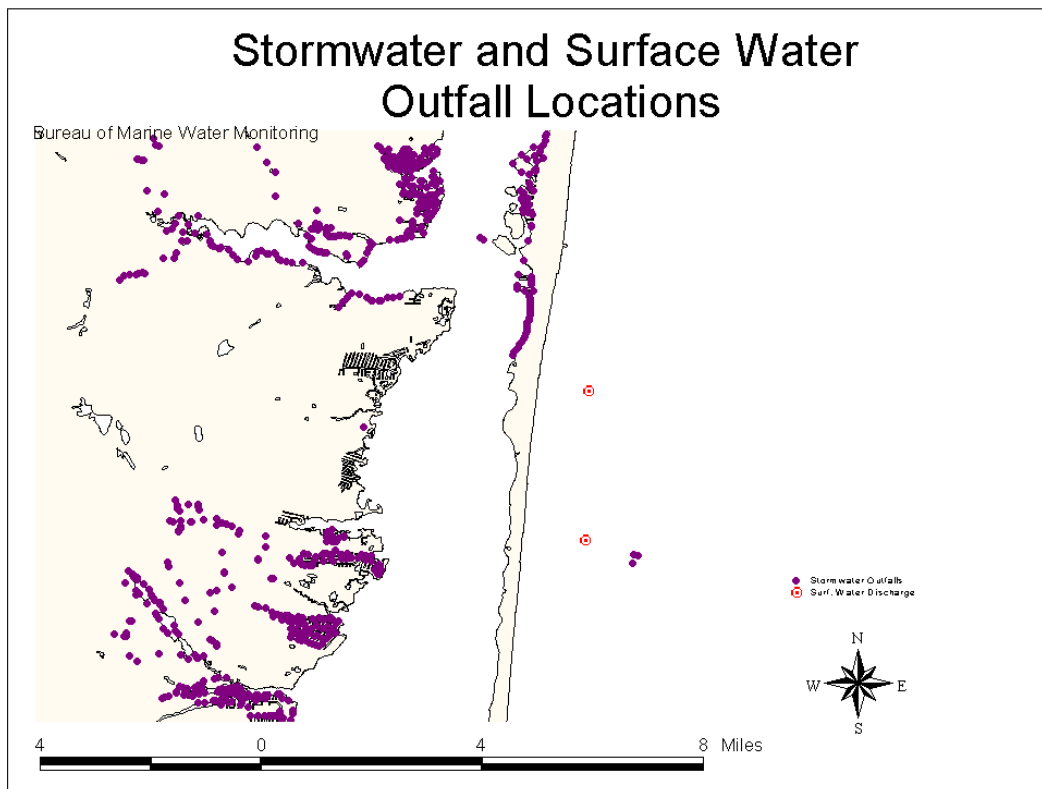


FIGURE 5: DIRECT DISCHARGES TO THE TOMS RIVER-BARNEGAT BAY AREA. STORM WATER DISCHARGES ARE SHOWN IN PURPLE. PERMITTED POINT SOURCE DISCHARGES ARE SHOWN IN RED.

INDIRECT DISCHARGES

The Department of Environmental Protection's Site Remediation Program has not alerted the Bureau of Marine Water Monitoring of any impact to the shellfish growing waters or shellfish resources of the Toms River-Barnegat Bay from any of the known contaminated sites or toxic release inventory sites in the area. The known contaminated sites and sites listed by the toxic release inventory are shown in Figure 6.

Numerous storm water outfalls are mapped in this area. See Figure 5. A co-operative investigation involving the DEP, Municipal and County Officials is underway to identify the source of elevated bacteria levels in the bay waters west of Seaside Heights. The bacteria levels may be associated with storm water discharges.

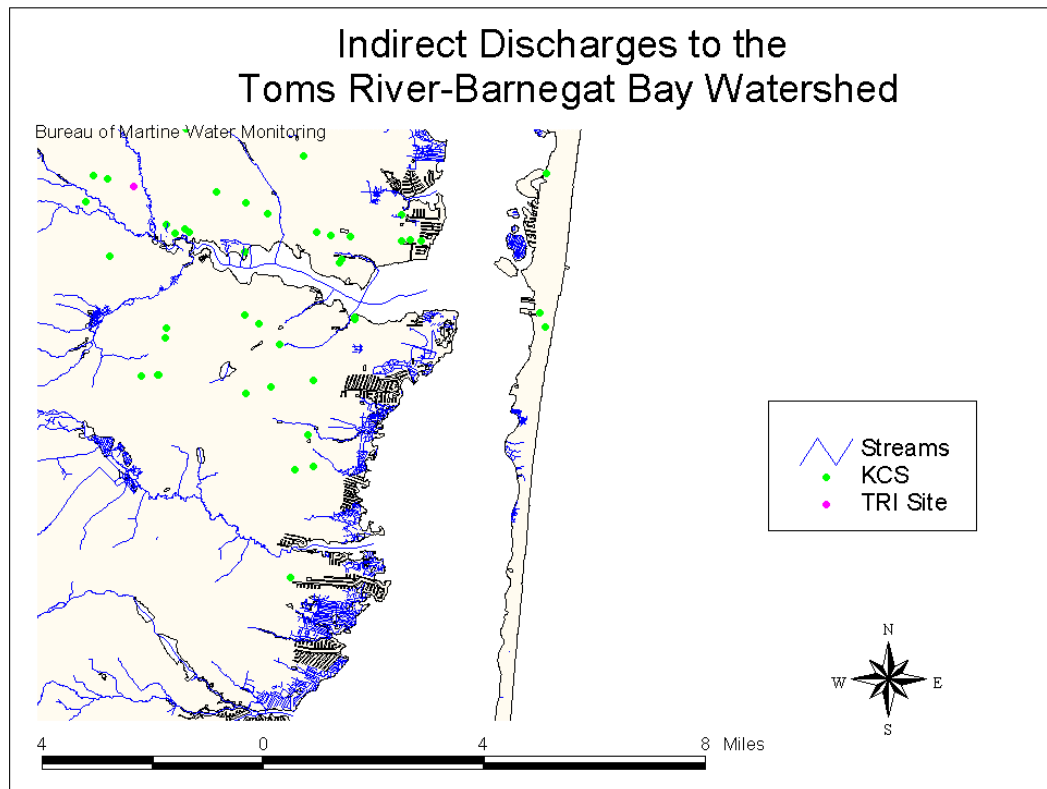


FIGURE 6: INDIRECT DISCHARGES TO THE TOMS RIVER-BARNEGAT BAY AREA. KNOWN CONTAMINATED SITES ARE DEPICTED IN GREEN. TOXIC RELEASE INVENTORY SITES ARE DEPICTED IN RED.

MARINAS

Marina facilities have the potential to affect the suitability of shellfish growing areas for the harvest of shellfish. The biological and chemical contamination associated with marina facilities may be of public health significance. New Jersey defines a marina as "any structure (docks, piers, bulkheads, floating docks, etc.) that supports five or more boats, built on or near the water, which is utilized for docking, storing, or otherwise mooring vessels and usually but not necessarily provides services to vessels such as repairing, fueling, security or other related activities" and

designates the confines of the marina as *Prohibited* for the harvest of shellfish. Adjacent waters are classified using a dilution analysis formula.

It is recognized by the NSSP *Guide for the Control of Molluscan Shellfish*, 1997, that there are significant regional differences in all factors that affect marina pollutant loading. The manual therefore allows each state latitude in applying specified occupancy and discharge rates. The NSSP guidelines assume the worst case scenario for each factor.

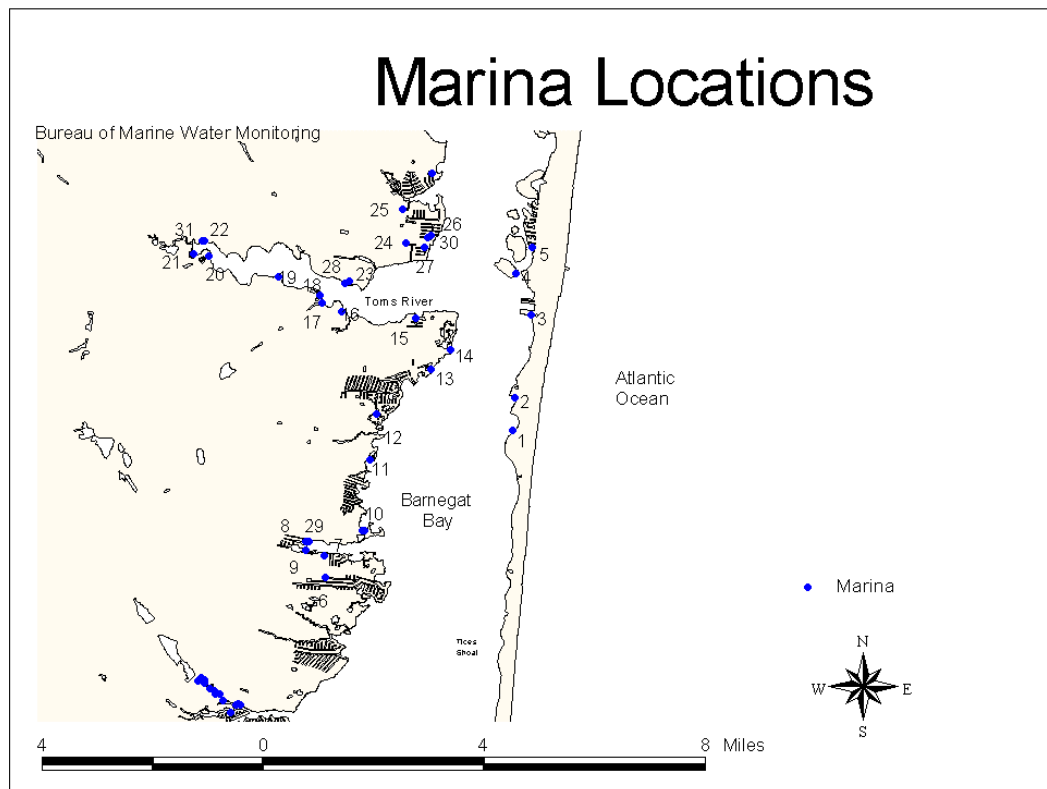


FIGURE 7 MARINAS LOCATED IN BARNEGAT BAY-TOMS RIVER

EQUATION 1 :MARINA BUFFER EQUATION. (ADAPTED FROM FDA. 1989):

$$BufferRadius(ft) = \sqrt{\frac{2 \times 10^9 (FC / person / day) \times 2 (person / boat) \times [(0.25 \times slips \geq 24') + (0.065 \times slips < 24')] \times 2}{140000 (FC / M^3) \times depth(ft) \times 0.3048 (M / ft) \times 2 (tides / day)} \times 3.28 (ft / M)}$$

Explanation of terms in equation:

Fecal coliform per person per day:	2 x 10 ⁹
Number of people per boat:	2
For slips able to accommodate boats > 24 feet (combination of factors yields multiplier of 0.25):	
Number of slips occupied:	50%
Number of boats occupied:	50%
For boats < 24':	6.5% discharge waste
Angle of shoreline:	180°, which results in factor of 2
Number of tides per day:	2
Depth in meters:	depth in feet x conversion factor
Water quality to be achieved:	140000 FC/meter ³
Convert meters to feet:	3.28

Marina buffer zones may be calculated using the formula above, or may be determined using a dilution analysis computer program developed by the State of Virginia and the USFDA. The computer program is used for complex configurations where the formula is unlikely to provide the needed accuracy.

There are 32 marinas in the Toms River-Barnegat Bay area. Their locations are shown in Figure 7 and listed in Table 1. Five of the marinas are located on the barrier island from Seaside Heights to South Seaside Park with the remainder located on the mainland between Bay Shore, Toms River and Laurel Harbor. Marine sanitary pump-out facilities for boat holding tanks are provided at the following marinas: Wheel House, Laurel Harbor, Lanoka Harbor, Good Luck Point, Ocean Gate, Stump Creek, River Bank, Lighthouse Point, Cozy Cove, Pier One and Nelson Marine.

The waters enclosed by the marina are classified as *Prohibited*; depending on the size of the marina and the water quality, water immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is active). Marina buffer zones were calculated using the formula above. The size of each buffer zone is listed in Table 1 and depicted in Figure 8.

In the summer of 1997 the Borough of Seaside Park, in co-operation with the New Jersey Clean Vessel Program and the Federal Government, launched the boat “Circle of Life” to serve as a sanitary waste pump-out facility for boaters. The “Circle of Life” has a 300 gallon holding tank and can be radio dispatched. In the summer season the vessel serves the needs of boaters at the Tices Shoal area of Island Beach State Park, a popular boat mooring area.

TABLE 1: MARINA FACILITIES LOCATED IN THE BARNEGAT BAY-TOMS RIVER GROWING AREA.

MARINA NAME	MAP LOCATION	NUMBER OF SLIPS	BUFFER (RADIUS IN FT.)
WHEEL HOUSE MARINA*	1	86	1073
RED TOP BOAT	2	150	1417
BERKELEY YACHT CLUB	3	190	1595
PELICAN HARBOR	4	40	732
BAYSIDE	5	50	818
LAUREL HARBOR*	6	177	1539
OCEAN BEACH MARINA SOUTH	7	104	1180
CEDAR CREEK	8	50	818
LANOKA HARBOR*	9	200	1636
TRIXIES LANDING	10	75	1002
WHILEY'S LANDING	11	20	517
RINDERER'S MARINA	12	25	578
BECKERS BOAT BASIN	13	23	555
GOOD LUCK POINT*	14	55	858
OCEAN GATE YACHT*	15	168	1499
SANTO MARINE CORP.	16	85	1067
STUMP CREEK SLIPS*	17	25	578
RIVER BANK MARINA*	18	215	1696
TOMS RIVER MUN. BOAT	19	15	448
LIGHTHOUSE POINT*	20	15	448
CEDAR COVE	21	50	818
JACK BAKER'S RESTAURANT	22	10	366
COZY COVE*	23	85	1067

BARNEGAT BAY CHRIS CRAFT	24	194	1611
MARINA NAME	MAP LOCATION	NUMBER OF SLIPS	BUFFER (RADIUS IN FT.)
EAST DOVER MARINA	25	60	896
PIER ONE*	26	65	933
ANCHOR REEF	27	72	982
Nelson Marine Basin*	28	95	1128
Up the Creek	29	72	982
Tide's In	30	45	776
Toms River Boat Works	31	25	578
Down's Fishing Camp	32	65	933

Source: Barnegat Bay Estuary Program Marina Survey. *=Pumpout Station Available.

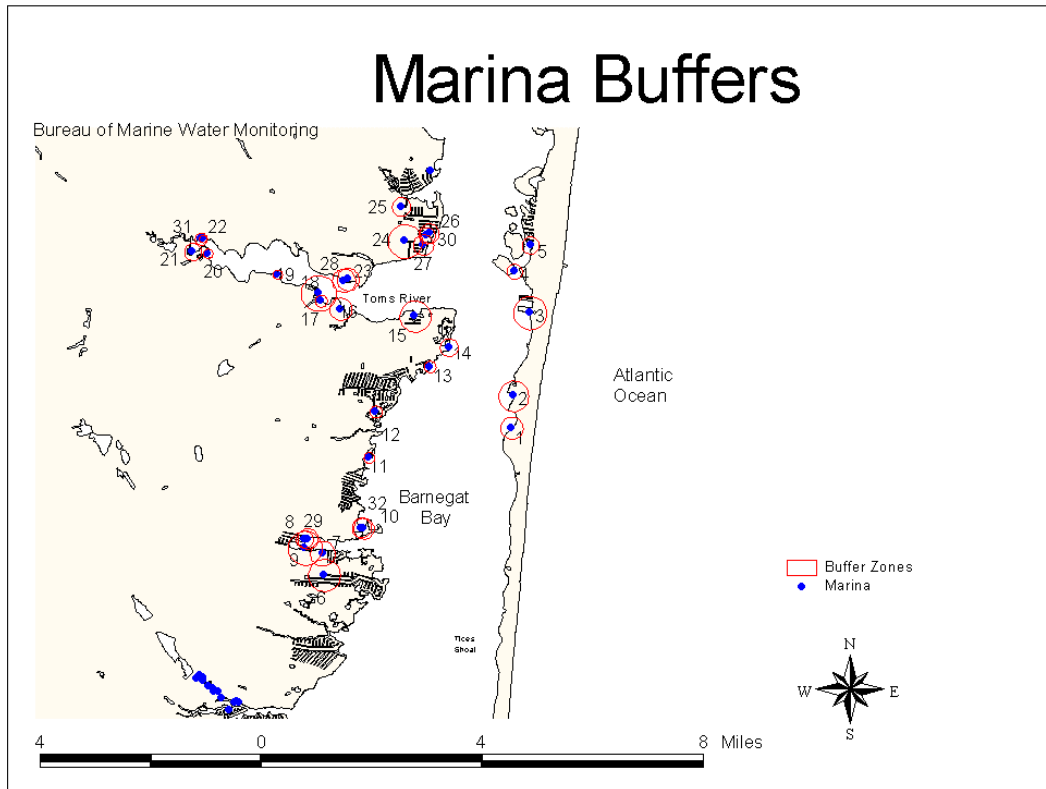


FIGURE 8: TOMS RIVER-BARNEGAT BAY MARINA BUFFERS

Land Use

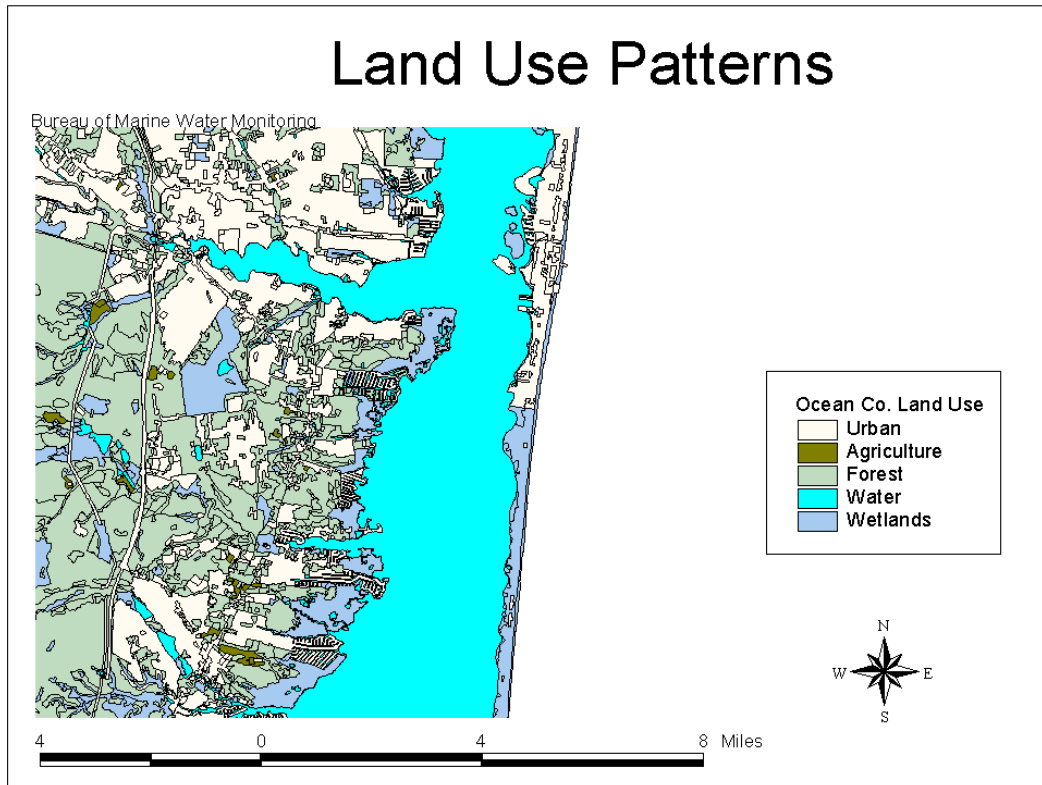
The land use patterns for the areas surrounding the Toms River-Barnegat Bay are urban, forest and wetland areas as depicted in Figure 9.

The area adjacent to the Toms River is highly developed. The western side of Barnegat Bay is bordered by tidal

wetlands, interspersed with small communities. Many of these communities are located on man-made lagoons. The eastern side of Barnegat Bay is bordered by a resort community in the northern section and state park in the central and southern sections.

There are ten communities bordering the Toms River-Barnegat Bay shoreline. The communities are Dover Township, Island Heights, South Toms River, Beachwood Boro, Pine Beach, Ocean

population density for these municipalities are given in Table 2. The summer time population for the barrier island communities of Seaside Park and Seaside Heights are estimated to be ten



Gate, Berkeley Township, Lacey Township, Seaside Park, and Seaside Heights. The population, area and

times higher than the year round population figures listed.

FIGURE 9: LAND USE PATTERNS FOR TOMS RIVER-BARNEGAT BAY GROWING AREA

TABLE 2: POPULATION, AREA AND DENSITY FOR COMMUNITIES

Municipality	Population (1990) Year Round	Area (Sq. Mi.)	Density
Dover Twp.	76371	44.0	1735
Island Heights	1470	0.6	2450
South Toms River	3869	1.2	3224
Beachwood Boro	9324	2.5	3729
Pine Beach	1954	0.6	3256
Ocean Gate	2078	0.5	4156
Berkeley Twp.	37319	42.9	870
Lacey Twp.	22141	87.0	254
Seaside Park	1871	0.9	2078
Seaside Heights	2366	0.3	7886

Source: 1996 New Jersey Municipal Directory.

HYDROGRAPHY AND METEOROLOGY

The Toms River drainage basin covers an area of approximately 123 sq. miles. The discharge volume for the river as gauged at the Route 527 bridge, 2.6 miles northwest of the community of Toms River, is 450 cubic feet per second

(base discharge). The peak discharge in 1997 was approximately 1000 cubic feet per second (USGS, 1997). The highest recorded peak flow is approximately 2000 ft³/sec, while the mean discharge is approximately 200 ft³/sec.

PRECIPITATION EFFECTS

Available precipitation records for the area for the time period covered by this report are shown in Appendix C. There has not been any significant change in the hydrography of the Barnegat Bay-Toms River since the last report (Farnsworth, 1997). The primary

weather station for this area is Toms River. The secondary weather station for this area was formerly Tuckerton. This weather station may no longer exist. The next nearby weather station is located at Long Branch. The secondary station data is used when data from the

primary station is incomplete.

Rainfall data from each of these weather stations is incomplete. The Bureau of Marine Water Monitoring is looking for alternate sources for rainfall data for the Barnegat Bay-Toms River area.

Available rainfall data for the time covered by this report indicates that four sampling runs are within 72 hours after a major rainfall. The runs were on 8/20/92, 11/16/95, 9/19/96 and 10/21/96 when 3.80", 3.07", 3.87" and 3.51" of rainfall fell respectively within a 72 hour time period prior to sample collection. All stations sampled on these runs showed degraded bacterial water quality, probably due to storm water runoff inputs. Sampling data is listed in Appendix F3.

SEASONAL EFFECTS

An evaluation of summer vs. winter data (t-test probability <0.05) indicated a seasonal impact occurs at two sampling stations in the Barnegat Bay (1633D, 1651). One of these stations is located

TIDAL EFFECTS

The tidal range for the Barnegat Bay as measured at Bayshore is approximately two feet (USGS, 1997).

A tidal effect (t-test probability<0.05) was evident at 18 stations. Although the stations are scattered and surrounded by other stations not showing a tidal impact,

In the Toms River, which is sampled under the Adverse Pollution Condition of rainfall sampling strategy, the Bureau normally determines if sampling stations show increasing MPN values with rainfall using an analysis of correlation coefficients. However, since most of the samples were collected after rainfall, (i.e., there were no dry weather samples) it is unlikely that a significant correlation between precipitation and coliform MPN value would be found. Typically, such a correlation can be demonstrated only when samples are obtained under varying conditions, including dry weather, after storms of low intensity and/or duration and after storms of high intensity or duration.

near Seaside; the other is located near one of the lagoon communities in the vicinity of Forked River. The summer vs. winter data is listed in Appendix B.

many of them are located near the junction of the Toms River and Barnegat Bay. The data for ebb vs. flood tide is listed in Appendix D. See Figure 10 for sampling stations impacted by tide.

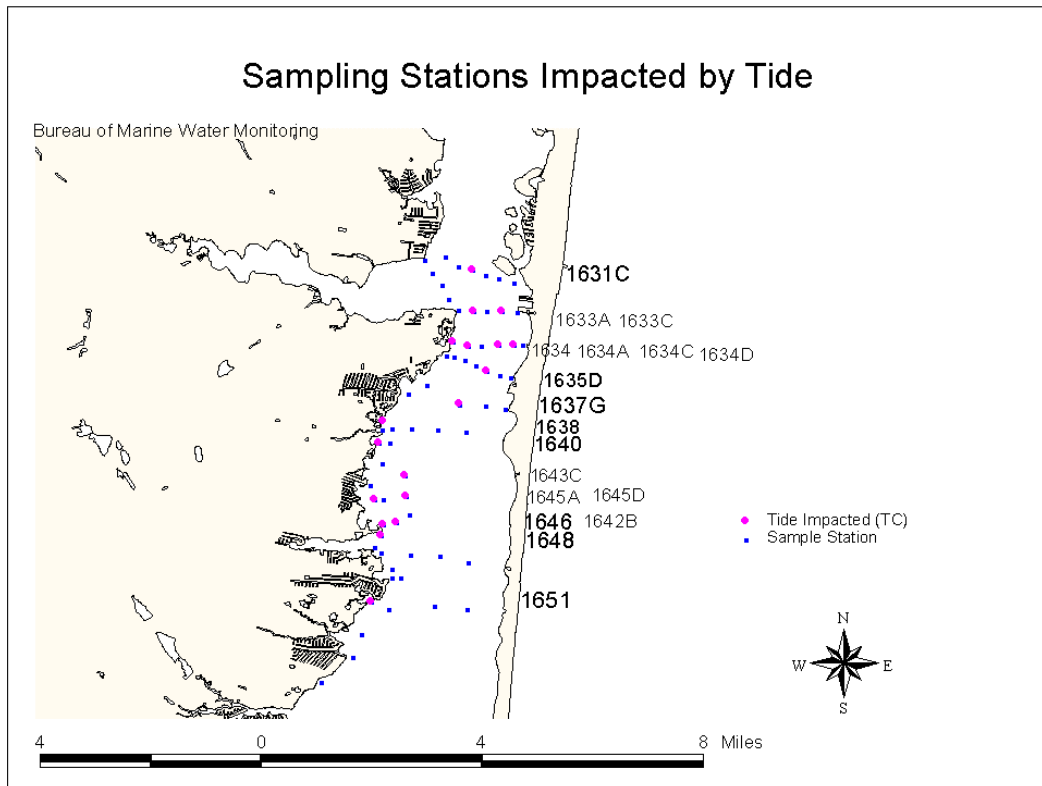


FIGURE 10: SAMPLING STATIONS SHOWING TIDAL EFFECT.

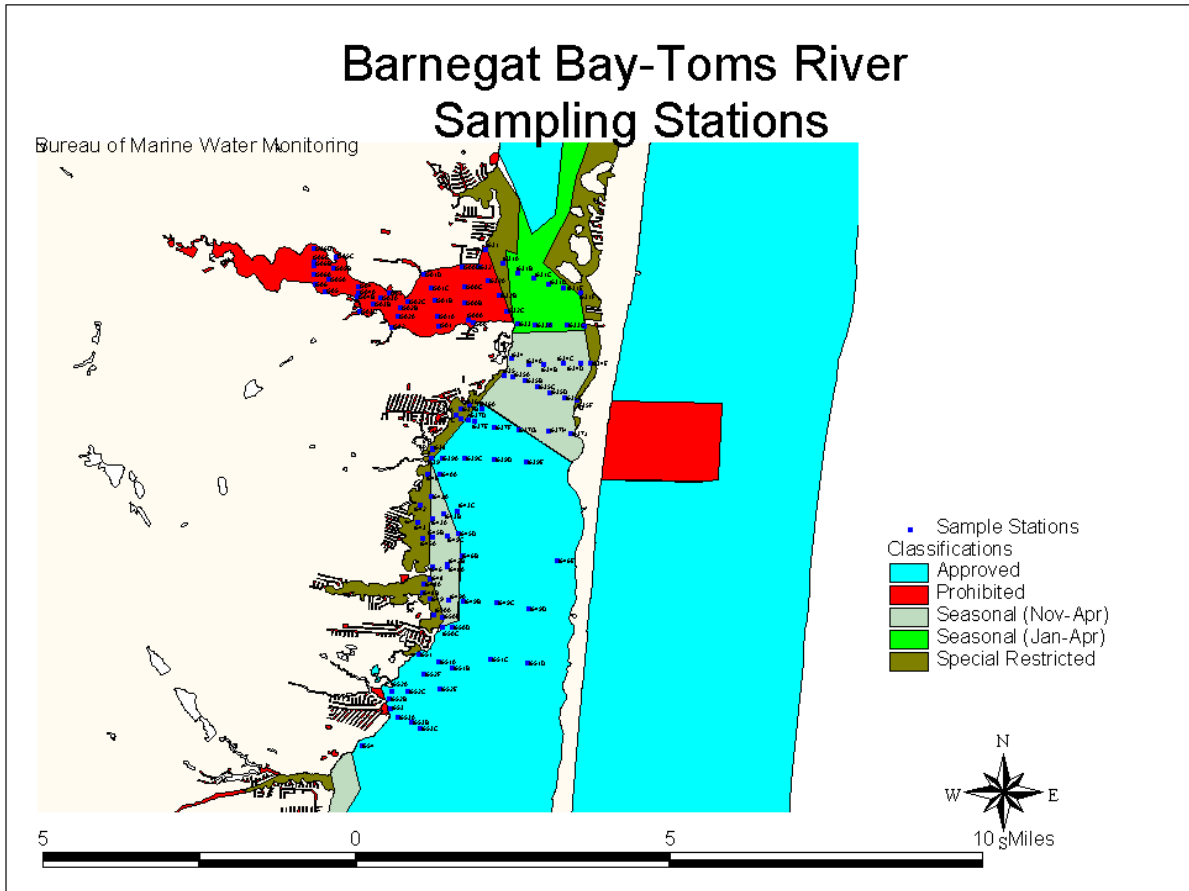
WATER QUALITY STUDIES

BACTERIOLOGICAL QUALITY

A total of 4,334 water samples were analyzed for total coliform (TC) and fecal coliform (FC) bacteria during the period November 1991 through September 1998. See Figure 11 for

sampling station locations. The data for this report was collected during 81 sampling runs from 133 stations in the Barnegat Bay-Toms River area.

FIGURE 11: SAMPLING STATION LOCATIONS IN THE TOMS RIVER-BARNEGAT BAY.



Samples collected during the period November 1991 through September 1997 were collected under the Adverse Pollution Condition of rainfall in the Toms River and Barnegat Bay. For the Sampling Year 1997-1998 the sampling strategy was modified to Systematic Random Sampling only in the Barnegat Bay.

See Figure 12 for SRS sampling station locations. The Toms River remained under the APC of rainfall sampling strategy.

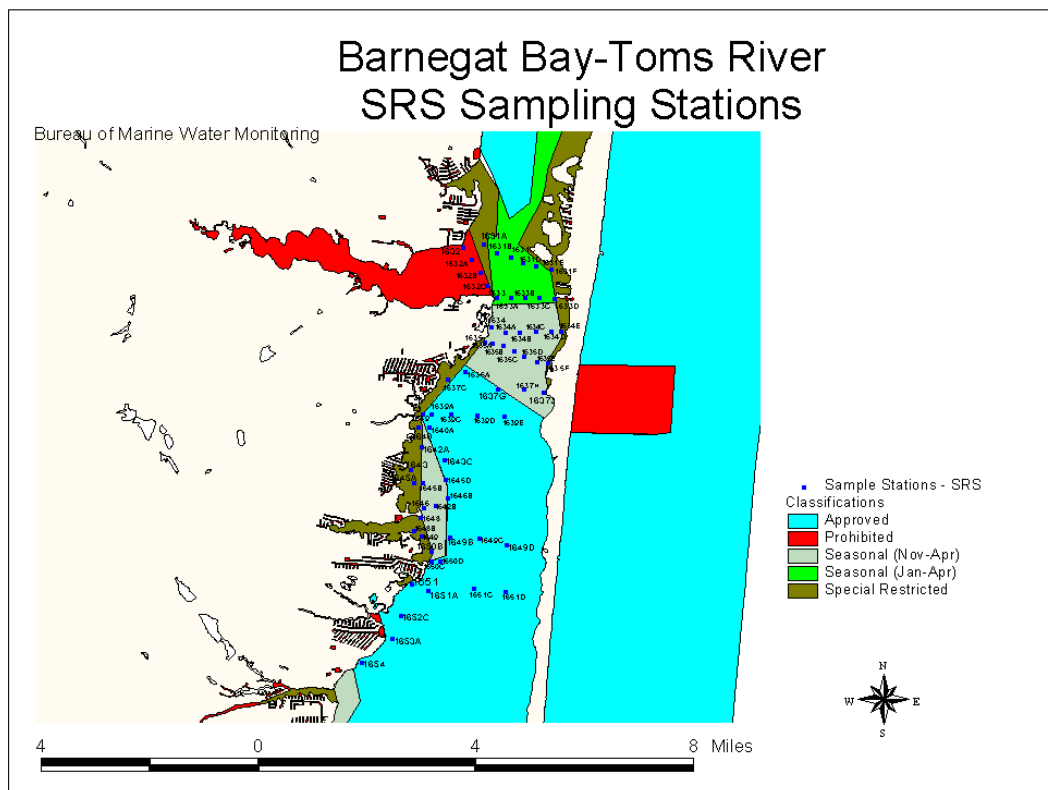


FIGURE 12: SYSTEMATIC RANDOM SAMPLING STATION LOCATIONS.

TOMS RIVER

The Toms River is sampled under the Adverse Pollution Condition of rainfall. There were 23 sampling runs completed in the river from 7/13/94 through 2/24/98. A single sampling run on 2/10/97 was analyzed only for fecal coliform bacteria. All of the remaining runs were analyzed for total coliform (TC) and fecal coliform (FC) bacteria.

The 15 most recent data sets are listed in Appendix F2. They cover the time period from 9/10/96 to 2/24/98. There were four sampling runs completed in the 1997-1998 sampling year out of the 5 run minimum requirement under the

APC of rainfall sampling strategy. Six sampling runs had been planned in the 1997-1998 Sampling Year. Two runs were not completed because of a lack of rainfall.

A review of all the sampling data from the Toms River suggests that a reclassification of the river may be possible in the future based on the collection and evaluation of additional data. See Figure 13 for the APC sampling stations that support *Special Restricted* criteria in the Toms River on a year round basis and Figure 14 for the sampling stations that support *Approved*

criteria year round.

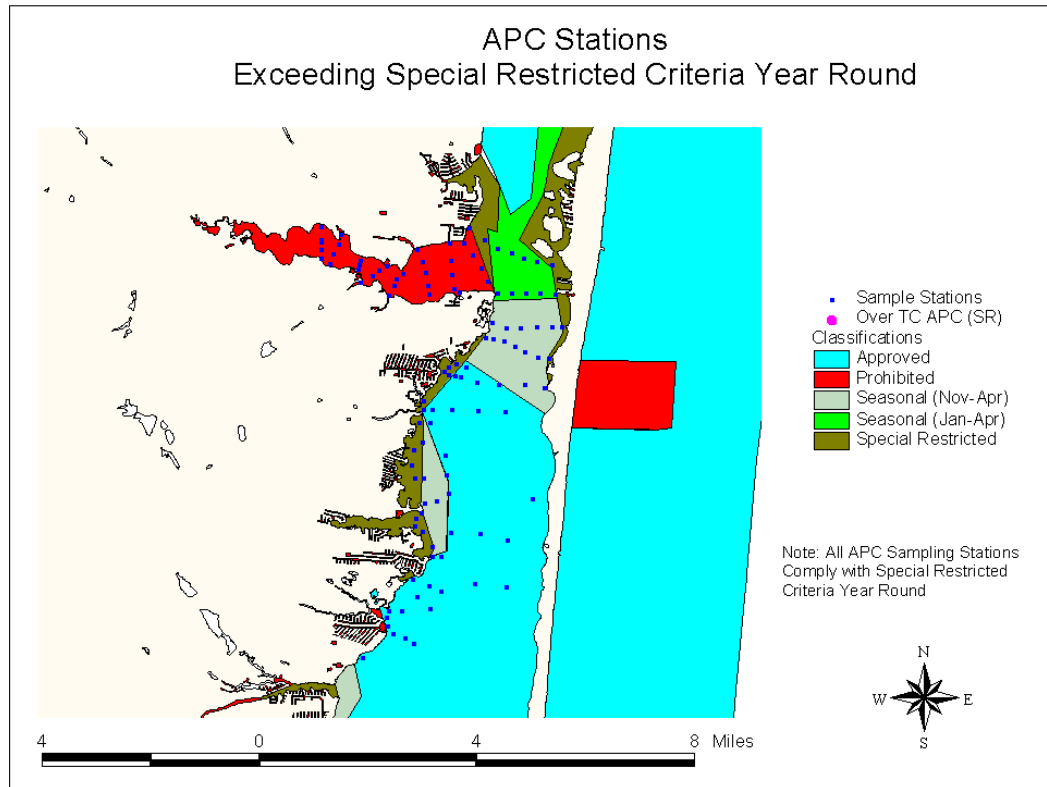


FIGURE 13: ALL APC SAMPLING STATIONS IN THE TOMS RIVER SUPPORT SPECIAL RESTRICTED CLASSIFICATION.

The Toms River is currently classified as *Prohibited*. However, based on this data set, the entire River meets the criteria for *Special Restricted* waters.

The eastern section of the River meets the criteria for *Approved* status.

However, to obtain enough data points to evaluate the area in accordance with the NSSP criteria (15 sets of data), it was necessary to evaluate data that was several years old.

Since this area is currently classified as *Prohibited*, regular sampling is not required under the NSSP guidelines. In

addition, the biological resource in the River is limited. Therefore, sampling was sporadic for several years. A regular sampling program was re-established in 1997, but there is not yet sufficient recent data to make a determination regarding any potential classification upgrade in the Toms River.

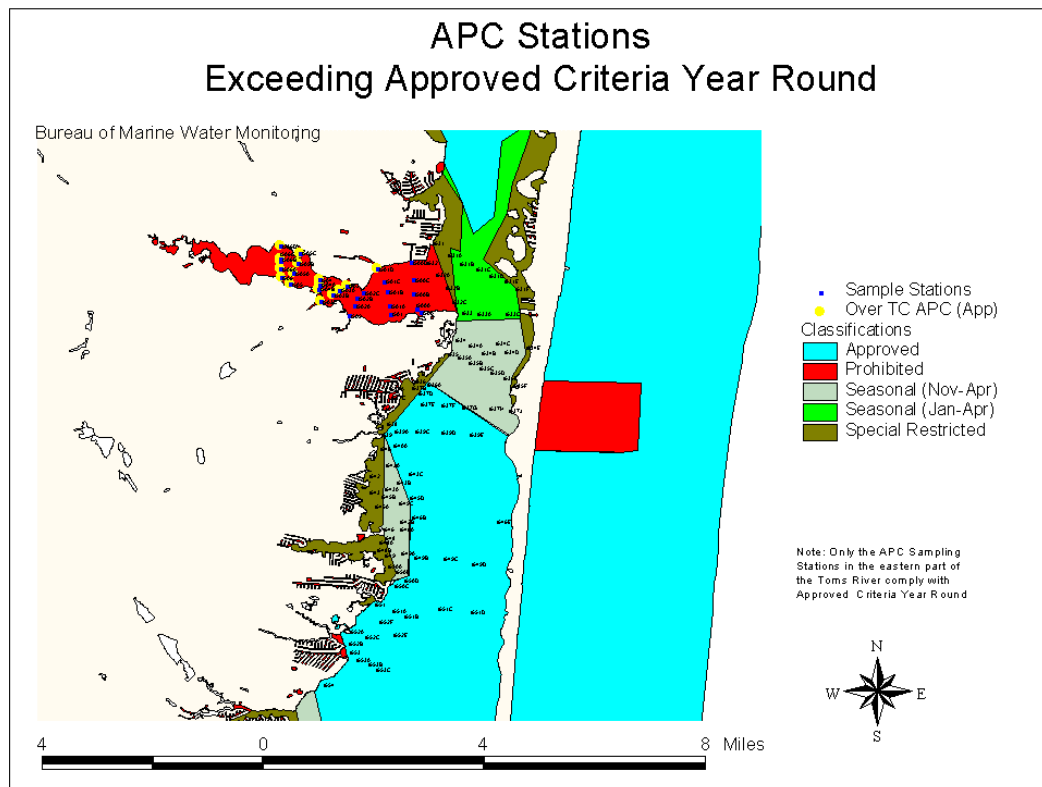


FIGURE 14: THE APC SAMPLING STATIONS LOCATED IN THE EASTERN PART OF THE TOMS RIVER SUPPORT APPROVED WATER CRITERIA ON A YEAR ROUND BASIS.

BARNEGAT BAY

In order to evaluate the Barnegat Bay area under the SRS sampling strategy it was necessary to go back to 10/1/91 to have sufficient data to comply with the requirement of a minimum of 30 data sets per station. Additional data retrievals were evaluated going back to 10/1/92 and 10/1/93 so that certain sampling stations were closer to the 30 data set requirement. These data retrievals support the current classification and are listed in Appendix F4 and F5.

It was necessary to go back to 1/1/86 to have sufficient data to evaluate for the *Seasonal* November and *Seasonal* January waters. All sampling stations in the Barnegat Bay meet or support their respective criteria for *Approved*, *Seasonal* or *Special Restricted* waters based on a minimum of 30 data sets going back to 1991 (or 1986 for the *Seasonal* Waters). See Figure 15 for the Barnegat Bay sampling stations that exceed *Approved* water criteria on a year round basis.

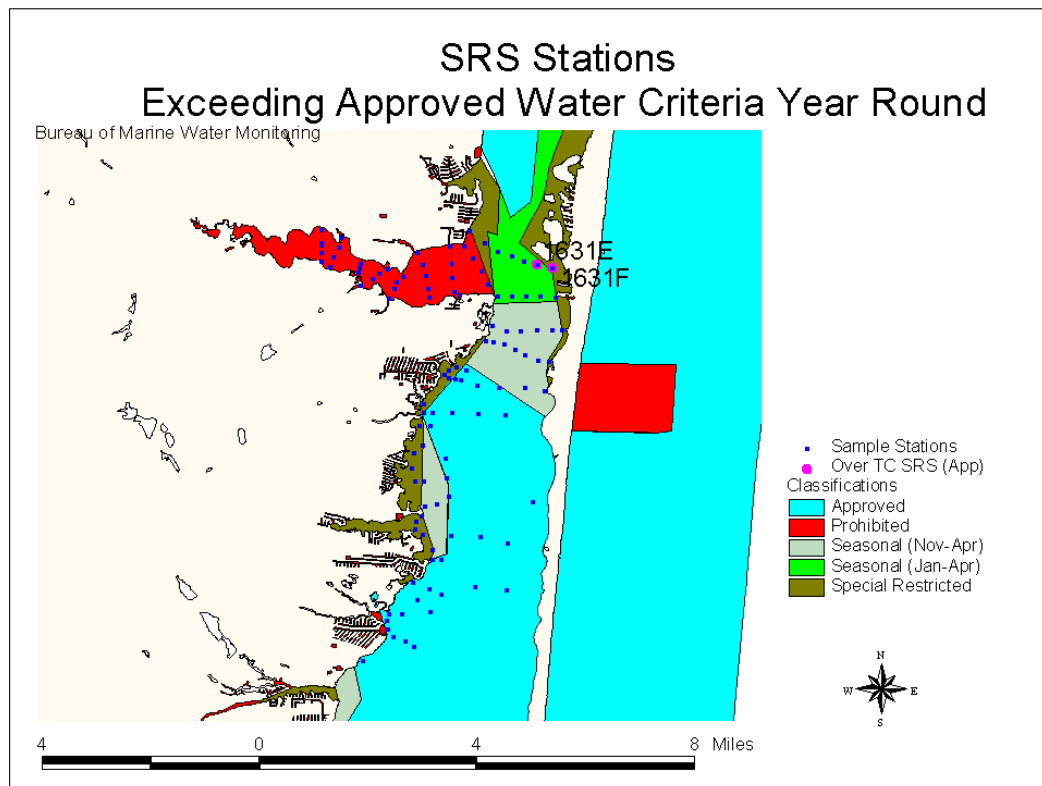


FIGURE 15: ONLY TWO SRS SAMPLING STATIONS EXCEED APPROVED WATER CRITERIA YEAR ROUND.

Sampling stations 1631E and 1631F, located on the south side of Pelican Island to the west of Seaside Heights are the only two stations that exceed *Approved* criteria on a year round basis in the Barnegat Bay. Station 1631E is located in *Seasonal* January waters and station 1631F is located in *Special Restricted* waters. Both sampling stations comply with their respective criteria for classification as *Seasonal* or

Special Restricted waters. See Figure 16 for SRS sampling stations exceeding *Special Restricted* criteria year round. Figure 17 shows the SRS sampling stations exceeding the criteria for *Seasonal* waters during the period January 1 through April 30. Figure 18 shows the SRS sampling stations exceeding the criteria for *Seasonal* waters during the period November 1 through April 30.

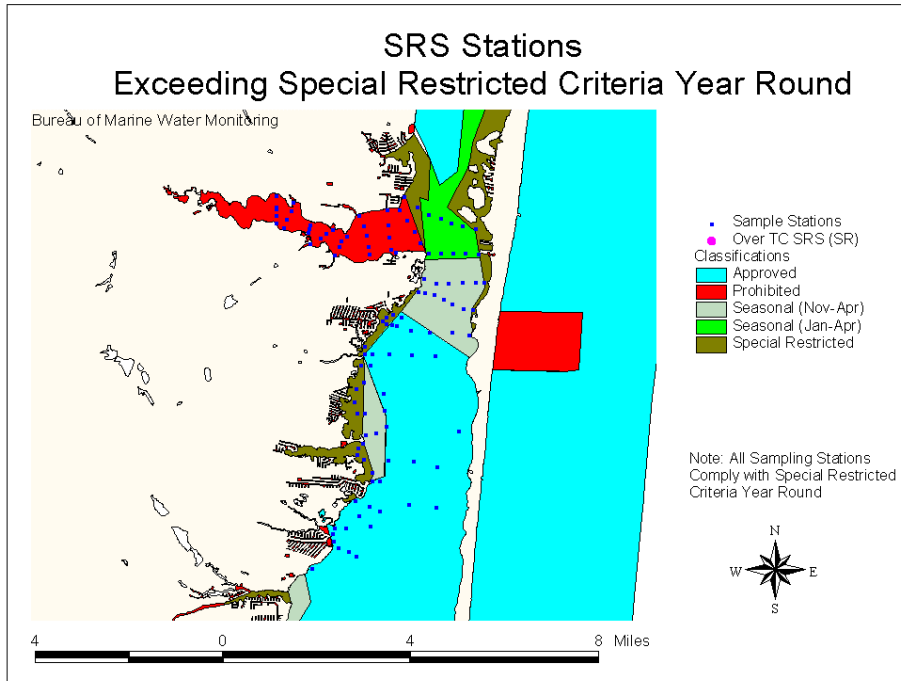
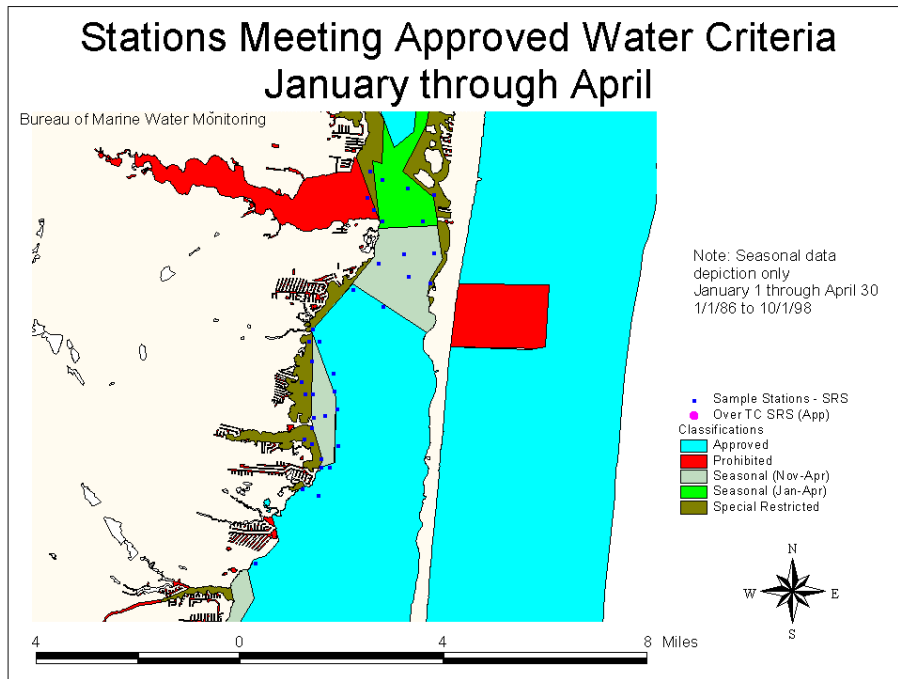


FIGURE 16: ALL SRS SAMPLING STATIONS MEET SPECIAL RESTRICTED CRITERIA YEAR ROUND.

FIGURE 17: ALL SRS SAMPLING STATIONS MEET APPROVED CRITERIA JANUARY 1 THROUGH APRIL 30.



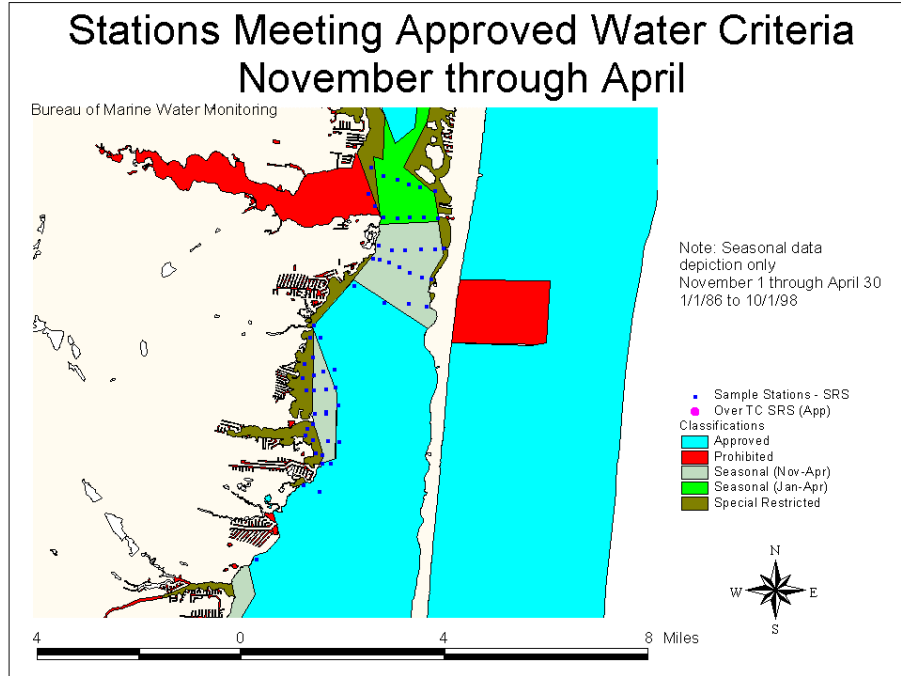


FIGURE 18: ALL SRS SAMPLING STATIONS MEET APPROVED CRITERIA NOVEMBER 1 THROUGH APRIL 30.

There are four sampling stations located at the mouth of the Toms River in *Prohibited* waters. The stations are 1632, 1632A, 1632B and 1632C. These stations are sampled under the SRS strategy and meet *Approved* water criteria however, this was based on a minimum of 30 data sets going back to 1991 (or 1986 for the *Seasonal* waters).

During the change over from the APC to the SRS sampling strategy 30 of the most recent samples collected at each station are required for classification. According to the Model Ordinance and the NSSP Manual, if 30 SRS samples are not available, then 15 of the most recent APC samples may be used with 15 SRS

samples to obtain a total sample size of 30 for classification. Additional SRS samples shall replace the APC samples on a chronological basis until all APC samples have been eliminated. During this transition period the growing area classification may be maintained under the transition strategy until sufficient data are available to classify under the SRS sampling strategy. A schedule for SRS sampling shall be documented in the master file for the growing area prior to implementation. The Bureau of Marine Water Monitoring is scheduling additional sampling runs so that the 30 SRS data sets are available more quickly.

RELATED STUDIES

This area is routinely sampled 4 times per year for nutrients and dissolved oxygen. Those results are summarized and evaluated in a separate report concerning nutrients in the coastal waters.

In general, the waters of Barnegat Bay exhibit relatively low dissolved oxygen levels during the summer months. In

addition, the levels of nutrients such as nitrogen and phosphorus are somewhat elevated. These observations, combined with algal blooms in early summer, indicate that the Bay is likely to be under considerable environmental stress from anthropogenic inputs of nutrients.

INTERPETATION AND DISCUSSION OF DATA

The bacteriological data collected during the period covered by this report is listed in the Appendices. These data were collected under the combined sampling strategies of Adverse Pollution Condition (rainfall) and the Systematic Random Sampling.

An evaluation of the data shows no significant change in water quality (based on total coliforms) during the period of evaluation. The bacteriological data for each sampling station complies with or supports their respective criteria for *Approved*, *Seasonal* or *Special Restricted* classification under the Total Coliform Standard. Based on these data, the area is correctly classified.

The sampling stations located in the *Seasonal* and *Special Restricted* waters that meet *Approved* water criteria on a year round basis have the potential for upgrade in the future. The potential for upgrade should be based on the collection and evaluation of additional (and especially more recent) data

collected under the Systematic Random Sampling strategy, combined with a favorable Sanitary Shoreline Survey.

Four sampling stations (1632, 1632A, 1632B and 1632C) located in the *Prohibited* waters of the Toms River meet *Approved* water criteria based on combined sampling strategy data going back to July 1996 (Appendix F1).

Evaluation of sampling data in the Barnegat Bay indicates that all stations meet *Approved* water criteria on a year round basis, with the exception of stations 1631E and 1631F. Station 1631E is located in *Seasonal* January waters and Station 1631F is located in *Special Restricted* waters.

These two sampling stations are located adjacent to an area near Seaside Heights (north of the Mathis bridge on the eastern edge of the Bay) where high coliform levels have been observed. A cooperative investigation involving the DEP, local and county officials is underway to determine the source of the elevated bacteria levels in this area.

CONCLUSIONS

CLASSIFICATION

No changes in classification are required. The area is correctly classified.

Toms River

All sampling stations in the Toms River appear to support the *Special Restricted* classification. The sampling stations located in the eastern part of the Toms River support *Approved* water criteria on a year round basis.

A reclassification of the Toms River may be possible in the future based on the collection and evaluation of additional sampling data and a favorable sanitary shoreline survey.

Barnegat Bay

All sampling stations in Barnegat Bay, except for a single station near Seaside

Heights, meet or support their respective criteria for *Approved*, *Seasonal* or *Special Restricted* waters

The sampling stations located near the confluence of the Toms River and Barnegat Bay (in the *Seasonal* and *Special Restricted* waters) that meet *Approved* water criteria on a year round basis have the potential for upgrade in the future. The potential for upgrade should be based on the collection and evaluation of additional and especially more recent data collected the SRS strategy and a favorable sanitary shoreline survey.

SAMPLING SCHEDULE

Since there is sometimes difficulty in obtaining enough sampling runs due to dry weather, the sampling schedule in the Toms River should be changed to the SRS strategy. This is possible because

there are no known effluent discharges into the river. (For example, only four sampling runs completed in the 1997-1998 Sampling Year due to a lack of rainfall.)

RAINFALL EFFECTS

No stations sampled show a strong correlation with rainfall for this data

period. However, when the historical data is evaluated, strong rainfall effects

are seen adjacent to the shoreline. The lack of rainfall effect for this data set is an artifact of the sampling strategy, where most data was collected after rainfall.

There have been some problems with obtaining comprehensive rainfall data

from a nearby NOAA or NOAA-cooperative weather station. However, we anticipate that this issue will be resolved as NOAA makes rainfall data more readily available in an electronic format.

OTHER EFFECTS

Only two sampling stations in the growing area indicate a seasonal impact (summer vs. winter data).

A weak tidal effect was evident at 18 sampling stations. Most of the stations are located near the confluence of the

Toms River and Barnegat Bay, indicating a possible tidal effect in that area.

RECOMMENDATIONS

CLASSIFICATION

No changes in classification for the Barnegat Bay-Toms River are recommended at this time.

SAMPLING STRATEGY

It is recommended that we modify the sampling strategy for the assignment covering the Toms River from APC of rainfall to SRS starting in the 1998-1999 Sampling Year. It is recommended that a minimum of 10 runs should be scheduled for the Toms River in each of the 1998-1999 and 1999-2000 Sampling Years to provide 30 data sets for classification within a three year time frame.

A minimum of 10 runs should be scheduled in the Barnegat Bay for the 1998-1999 Sampling Year to provide additional SRS data more quickly.

The *Seasonal* waters should continue to be sampled during the summer season (May 1 through October 31) in order to evaluate these areas for potential upgrade in classification.

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APPENDICES

- A. Statistical Summaries
 - A1 Year Round (10/1/91 to 10/1/98)
 - A2 Seasonal Nov.1 through April 30 Only (1/1/86 to 10/1/98)
 - A3 Seasonal Jan.1 through April 30 Only (1/1/86 to 10/1/98)
- B. Seasonal Evaluation
- C. Precipitation
 - C1 Rainfall Correlation
 - C2 Cumulative Rainfall
- D. Tidal Evaluation
- E. Detailed Data Listing
 - E1 Year Round October 1, 1991 to October 1, 1998
 - E2 Seasonal November 1 through April 30 (1/1/86 to 10/1/98)
 - E3 Seasonal January 1 through April 30 (1/1/86 to 10/1/98)
- F. Supplemental Data Listing
 - F1 SRS, 30 data sets (Stations 1631E, 1631F, 1632-1632C)
 - F2 APC, 15 data sets (9/10/96-2/24/98)
 - F3 Sampling runs of 8/20/92, 11/16/95, 9/19/96 and 10/21/96
 - F4 Year Round Summary 10/1/92-10/1/98
 - F5 Year Round Summary 10/1/93-10/1/98
 - F6 Seasonal November Summary 10/1/91-10/1/98